Evaluating Learners' Online Learning Experience of Informal Learning Environments: A LIWC Analysis

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Online video-based content, such as massive open online courses (MOOCs) or educational videos on YouTube, are popular ways for individuals to learn outside of a traditional learning space. Video-based informal learning environments fit in the framework of community of inquiry (CoI), with unique teaching, cognitive, and social presence. Videos on the environment provide direct instruction representing teaching presence, and the feature of online discussion allows learners to comment on instructional materials and interact with other learners, which show social and cognitive presence. Multi-format informal learning environments bring learners diverse learning experiences and analyzing the content of online discussions can help us better understand learners' experiences. This study uses Linguistic Inquiry and Word Count (LIWC) to evaluate learners' learning experiences on YouTube and edX through the construct of CoI. After matching LIWC's keywords with social presence and cognitive presence, we analyze learners' comments (N = 6,938) collected from YouTube and edX. Our findings reveal that there is a more differentiated cognitive presence and a more similar social presence between YouTube and edX.

Introduction

The Internet enables learners to study whenever and wherever and video-based informal learning environments are becoming increasingly important, even more so after the pandemic (Haavisto, 2021). YouTube does not only work as an entertainment platform but also as a place where lots of learners gather (Vizcaíno-Verdú et al., 2019). EdX is a MOOC platform that provides courses from prestigious institutions, and learners visit the website and watch video-based courses at their own pace.

Unlike formal learning, informal learning does not have instructors interact with students, control the pace of content, or identify what learners are understanding. Due to the lack of standardized exams and a low rate of survey response (Oudeweetering, 2018), it is hard to know much about informal learners' experiences. Comments are one way to investigate learners' experiences and both environments include discussion features as part of the interface. For example, YouTube has post-video comments and edX has a discussion forum, which both work as an asynchronous discussion space for learners (Delello et al., 2019). Since Garrison et al. (1999) proposed the theoretical framework of community of inquiry (CoI), it has become a solid foundation for investigating online learning environment. More recently, social network platforms show their potential for fostering a CoI (Wang & Chen, 2020). In YouTube's post-video comments, learners share their emotions (Veletsianos et al., 2018), show gratitude (Lee et al., 2017), and construct knowledge (Dubovi & Tabak, 2020). Similarly, edX's discussion forum is a place where learners share their experiences, ask questions, and report issues. These posts contribute to fostering a CoI and the understanding of learners' learning experiences, thus, helping content producers improve content quality (Liu et al., 2016).

In this paper, we investigate the similarities and differences between learners' experience (i.e., CoI) of two popular video-based informal learning environments containing asynchronous discussion features, YouTube and edX. This is achieved by comparing the frequency of keywords found in learners' comments accompanying educational videos on the two environments and further categorizing them via the constructs of social and cognitive presence.

Community of inquiry

There are three components of CoI: social presence, cognitive presence, and teaching presence (Garrison et al., 1999). Social presence is the extent that learners can express themselves as individuals in the learning environment and includes expressions of emotion, open communication, and group cohesion. Cognitive presence is the extent that learners can co-develop meaning through communicating. Teaching presence is how direct instruction, facilitating discourse, and instructional design facilitate social and cognitive presence.

Research questions

YouTube and edX are popular video-based online informal learning environments that likely foster unique CoIs. Previously, the social and cognitive presence found of these environments has been studied independently by looking at learners' comments. To our knowledge, no work has directly compared differences

in the CoI characteristics of these two popular online informal learning environments. Is there evidence of higher cognitive and social presence to be found in learners' discussion on the more structured edX than the unstructured YouTube? Given this, the following research questions guided this study:

1. How do online informal learning environments foster a CoI?

2. How do social and cognitive presence differ between unstructured (YouTube) and structured (edX) informal online environments?

Based on our research questions, we have two hypotheses:

1. YouTube's social presence (as measured by LIWC keywords) should be significantly different from edX's.

2. YouTube's cognitive presence (as measured by LIWC keywords) should be significantly different from edX's.

Method

This quantitative study focuses on exploring learners' discussion and learning experiences in two online informal learning environments. The data consists of a total sample of n = 2,889 respondents from YouTube and edX with a total of 6,938 comments. For this research, we chose the math course The Magic of Fibonacci Numbers from the TED Channel on YouTube. This video has 1 lecture, but 3,204 comments posted by 2,306 learners. In edX, we chose the math course Calculus 1A: Differentiation, published by MIT. It has 42 lectures with 3,734 comments posted by 583 authors, including one instructor. This research uses the LIWC-22 Dictionary of LIWC analysis (Boyd et al., 2022) to analyze comments' content, a total of 4,785 comments are valid for this analysis.

Two researchers independently categorized each of the LIWC dimensions as either social or cognitive presence based on the definitions of each CoI element and the keywords from the LIWC dictionary representing the dimension. The inter-rater reliability of the coding was high, k = .90, and discrepancies were resolved via discussion. Social presence including the following 6 dimensions: self-identify, affiliation, affect, social process, culture, and conversational. Cognitive presence included the following 7 dimensions: summary variables, drives, cognition, affect, states, motives, perception.

Results

The frequency of keywords in each dimension can be found in Table 1 and Table 2 and the means reflect their percentage relative to the total number of words overall. In Table 2, the summary variables from analytical thinking to authentic are standardized composited variables transformed to a scale from 1 to 100. Independent sample t-tests were conducted on the means and effect sizes calculated to compare the percentage of each category between YouTube and edX. For significant differences, the larger of the two means is highlighted in a color to reflect the size of the effect. The effect sizes are defined, and color coded as follows: d (.01 - .19) = very small/blue, d (.2 - .49) = small/green, d (.5 - .79) = medium/yellow, and d (.8+) = large/red (Sawilosky, 2009).

H1. By highlighting significant effects and their relative size in Table 1, differences in social presence between the environments emerge. Overall, differences range from very small to small. For self-identity words, edX learners express more personal-centered representations by using more 1st person singular and 1st person plural words than YouTube's. EdX comments also have more affiliation words than YouTube's. For affect, YouTube comments have more positive words while edX comments have more negative ones, except for anger and swear words. For social processes, edX comments contained more social words including social behavior, prosocial behavior, politeness, moralization, and communication words, however, YouTube comments have more interpersonal conflict words, social referents words, and acquaintances words. It seems that edX learners perform more politely than YouTube learners. YouTube comments garnered more ethnicity words than edX comments, which may show more diversity characteristics of YouTube. YouTube comments contained more conversational words, except for assent. As an unstructured informal learning environment, the social presence of YouTube shows slightly more positive affect and culture than edX, which shows slightly more affiliation and social processes.

Table 1

Comparisons between YouTube and edX - Social Presence

Dimension	Category	Description/Most frequently used exemplars	YouTube		edX		t	p (two-tailed test)	Cohen's d
			Mean	SD	Mean	SD			
Self-identity	1st person singular	I, me, my, myself	2.5303	5.84189	3.7011	3.81986	8.068	<.001	0.23
	1st person plural	we, our, us, lets	0.386	1.90243	0.7073	1.17497	6.900	<.001	0.20
Affiliation	Affiliation	we, our, us, help	0.6141	2.47913	1.3075	1.94885	7.776	<.001	0.23
Affect	Positive tone	good, well, new, love	6.4264	17.34128	3.6459	5.34667	-7.263	<.001	-0.21
	Negative tone	bad, wrong, too much, hate	1.0594	4.3171	1.1722	1.45418	1.174	0.240	0.03
	Emotion	good, love, happy, hope	3.8641	13.33142	1.5107	2.65349	-8.180	<.001	-0.24
	Positive emotion	good, love, happy, hope	2.8506	11.86941	0.7832	2.27927	-8.081	<.001	-0.23
	Negative emotion	bad, hate, hurt, tired	0.6168	2.85377	0.6759	1.03531	0.925	0.355	0.03
	Anxiety	worry, fear, afraid, nervous	0.0156	0.28285	0.0421	0.25211	3.400	<.001	0.10
	Anger	hate, mad, angry, frustr	0.1082	1.27156	0.0132	0.10805	-3.510	<.001	-0.10
	Sadness	:(, sad, disappoint, cry	0.0427	0.75337	0.1137	0.59641	3.575	<.001	0.10
	Swear words	shit, fuckin, fuck, damn	0.2812	3.40617	0.0051	0.10213	-3.819	<.001	-0.11
Social processes	Social	you, we, he, she	7.4189	13.22121	8.9106	6.38112	4.850	<.001	0.14
	Social behavior	said, love, say, care	3.4832	9.10318	5.4091	5.22171	8.795	<.001	0.26
	Prosocial behavior	care, help, thank, please	0.58	3.75005	1.198	2.09295	6.891	<.001	0.20
	Politeness	thank, please, thanks	0.5828	4.98524	2.102	4.05647	11.449	<.001	0.33
	Interpersonal conflict	fight, kill, killed	0.0684	0.84525	0.0369	0.24354	-1.693	0.091	-0.05
	Moralization	wrong, honor, deserv, judge	0.2817	3.06031	0.2982	0.89726	0.245	0.806	0.01
	Communication	said, say, tell, thank	1.484	6.17349	3.5736	4.40189	13.291	<.001	0.39
	Social referents	you, we, he, she	4.0684	8.94624	3.5162	2.99857	-2.777	0.006	-0.08
	Family	parent, mother, father, baby	0.0981	1.24858	0.0215	0.16934	-2.866	0.004	-0.08
	Friends	friend, boyfriend, girlfriend, dude	0.0906	1.35677	0.0027	0.09972	-3.049	0.002	-0.09
Culture	Ethnicity	american, french, chinese, indian	0.4423	2.7762	0.0217	0.40498	-0.707	<.001	-0.21
Conversational	Conversation	yeah, oh, yes, okay	2.1838	9.58837	1.4776	2.01424	-3.407	<.001	-0.10
	Netspeak	:), u, lol, haha	1.5024	7.03832	1.2308	1.82679	-1.768	0.077	-0.05
	Assent	yeah, yes, okay, ok	0.2674	3.50116	0.2853	1.0206	0.232	0.816	0.01
	Nonfluencies	oh, um, uh, i i	0.1596	2.6186	0.0392	0.2336	-2.160	0.031	-0.06
	Fillers	rr, wow, sooo, youknow	0.4069	5.78751	0.0245	0.51365	-3.103	0.002	-0.09
				2,564		2,221			

The effect sizes are defined d (.01 - .19) = very small, d (.2 - .49) = small, d (.5 - .79) = medium, and d (.8+) = large. According to Cohen's d, the mean values are highlighted in four colors: blue (very small), green (small), medium (yellow), and large (red). Only the higher mean values of the category are colored.

H2. By highlighting significant effects and their relative size in Table 2, differences in cognitive presence between the environments emerge. Overall, differences in cognitive presence range from very small to large (see Table 2). For summary variables, YouTube comments contained more analytical thinking and clout words while edX comments have far more authentic words. EdX learners present more authenticity than YouTube learners. EdX comments contained more drive words such as drive, achievement, and power. For cognition, edX commentshave far more cognitive words, except for all-or-none and certitude. Thus, edX learners show more nuanced argumentation while YouTube comments are more confident and absolute. For affect, YouTube learners use more affect words than edX learners, expressing more positive emotion which also showed in Table 1. EdX comments contained more state words except for fatigue. YouTube commenters use more motive words, except for risk, which shows that edX learners have more sense of risk while YouTube learners engaged with more motivations overall. For perception, edX comments have more perception words, motion words, and space words while YouTube comments contain more attention words, visual words, auditory words and feeling words. As a structured learning environment with more directions and clear learning purposes, edX comments are more authentic, driven, cognitive and demonstrate clear statements. YouTube comments are more motivated, affective, and perceptive.

Table 2

Comparisons between YouTube and edX - Cognitive Presence

Dimension	Category	Description/Most frequently used exemplars	YouTube		edX		t	p (two-tailed test)	Cohen's d
			Mean	SD	Mean	SD			
Summary Variables	Analytical Thinking	Metric of logical, formal thinking	64.5236	35.01239	61.1338	24.94268	-3.803	<.001	-0.11
	Clout	Language of leadership, status	42.2763	26.9404	30.5948	25.96675	-15.211	<.001	-0.44
	Authentic	Perceived honesty, genuineness	24.5146	36.07189	53.2232	32.06854	28.898	<.001	0.84
Drives	Drives	we, our, work, us	1.8785	6.55995	3.0441	2.8159	7.776	<.001	0.23
	Achievement	work, better, best, working	0.9116	5.50675	1.3379	1.84197	3.483	<.001	0.10
	Power	own, order, allow, power	0.394	2.6239	0.414	0.92306	0.341	0.733	0.01
Cognition	Cognition	is, was, but, are	7.7585	11.5149	15.3376	6.45079	27.505	<.001	0.80
	All-or-none	all, no, never, always	0.881	3.59982	0.7872	1.85028	-1.107	0.268	-0.03
	Cognitive processes	but, not, if, or, know	6.8501	10.51882	14.498	6.41054	29.804	<.001	0.86
	Insight	know, how, think, feel	2.3235	5.94278	4.3667	3.39006	14.311	<.001	0.42
	Causation	how, because, make, why	1.1562	3.319	1.8162	1.84403	8.325	<.001	0.24
	Discrepancy	would, can, want, could	0.9003	3.0892	1.9901	1.94239	14.348	<.001	0.42
	Tentative	if, or, any, something	0.9074	3.19691	3.3939	3.16992	26.936	<.001	0.78
	Certitude	really, actually, of course, real	0.6237	3.41373	0.4125	0.96196	-2.821	0.005	-0.08
	Differentiation	but, not, if, or	1.3581	3.61734	3.8255	2.67185	26.490	<.001	0.77
	Memory	remember, forget, remind, forgot	0.0392	0.55844	0.0874	0.45333	3.249	0.001	0.09
Affect	Affect	good, well, new, love	8.1161	18.64844	4.8714	5.40158	-7.917	<.001	-0.23
States	Need	have to, need, had to, must	0.1898	1.43693	0.34	0.85583	4.308	<.001	0.13
	Want	want, hope, wanted, wish	0.1996	1.27754	0.2475	1.0526	1.402	0.161	0.04
	Acquire	get, got, take, getting	0.3032	2.58483	0.7549	1.19083	7.234	<.001	0.21
	Lack	don't have, didn't have	0.0288	0.6125	0.0925	0.47375	3.981	<.001	0.12
	Fulfilled	enough, full, complete, extra	0.0611	0.74532	0.0834	0.36472	1.284	0.199	0.04
	Fatigue	tired, bored, don't care, boring	0.0839	1.54518	0.0043	0.06932	-2.423	0.015	-0.07
Motives	Reward	opportun, win, gain, benefit	0.0852	1.21419	0.0612	0.38375	-0.893	0.372	-0.03
	Risk	secur, protect, pain, risk	0.0173	0.31195	0.1176	0.63769	7.048	<.001	0.20
	Curiosity	scien, look for, research, wonder	1.0312	5.94579	0.3613	1.09548	-5.233	<.001	-0.15
	Allure	have, like, out, know	5.0734	11.54325	4.5425	3.2876	-2.095	0.036	-0.06
Perception	Perception	in, out, up, there	4.5223	9.53375	6.9168	4.06494	11.002	<.001	0.32
	Attention	look, look for, watch, check	0.6572	4.51205	0.4012	0.87469	-2.632	0.009	-0.08
	Motion	go, come, went, came	0.5253	3.09634	0.9077	1.45415	5.334	<.001	0.16
	Space	in, out, up, there	2.3938	6.00938	4.7048	3.21251	16.226	<.001	0.47
	Visual	see, look, eye, saw	0.8841	3.58755	0.7937	1.33601	-1.123	0.262	-0.03
	Auditory	sound, heard, hear, music	0.2301	2.46712	0.0644	0.4421	-3.122	0.002	-0.09
	Feeling	feel, hard, cool, felt	0.2188	2.74183	0.1344	0.45804	-1.433	0.152	-0.04
				2,564		2,221			

The effect sizes are defined d (.01 - .19) = very small, d (.2 - .49) = small, d (.5 - .79) = medium, and d (.8+) = large. According to Cohen's d, the mean values are highlighted in four colors: blue (very small), green (small), medium (yellow), and large (red). Only the higher mean values of the category are colored.

Discussion

The social presences of edX and YouTube are similar, in general. However, a few differences are interesting to explore. A higher positive tone and attitude score reflects their choice of a more relaxed approach to learning (Khan, 2017). This might be influenced by the overall environment of YouTube, an entertainment-oriented social media platform. In contrast, edX expects students to create a structured learning community in the discussion, and students are expected to respond to other students' comments sincerely. Thus, this could explain the greater level of social processes words found in the edX comments. The cognitive presence of EdX is more differentiated from YouTube, the comments contain far greater frequency of authentic, drives, cognition, and states. This could be due to its structured nature, which may promote a higher expectation of cognitive presence for learners.

Learners' written comments on the two informal learning environments represent different learning experiences they had with each environment. By examining the comment data, we identified a more differentiated cognitive presence in edX and a more similar social presence between YouTube and edX.

Limitations

The limitations of this research should be considered. First, typos existed in comments, which are not as totally "clean" data for LIWC analysis. Second, emoji-mediated communication also plays an important role in comments of informal learning environments, however, this research did not take emoji-based data into consideration. Future studies could combine the teaching presence of video features and discuss the impact of teaching presence, while also finding a way to code for the use of emojis.

Conclusion

This study revealed that there are some representative characteristics representing the unstructured (YouTube) and structured (edX) informal online environments in the social presence and cognitive presence of CoI. YouTube and edX are similar in social presence but different in cognitive presence. As a structured informal learning environment, edX's curriculum design is more similar to formal learning environments by providing structured courses, helping students be more authentic, driven, and cognitive. Thus, structured informal online environments could provide learners with more cognitive perceptions.

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